

AUTOMATION IN PAPERMILL FINISHING HOUSE



K. Sudhakar



K. Sivarama Krishnan

Abstract:

Converting and Finishing is one of the most important function of a Paperboard mill operations. The paperboard produced in Jumbo reel form is cut into various sizes of rolls and sheets, packed and despatched to Customers as per their requirements. In order to cope up with the customer demands on time in full (OTIF) deliveries and quality it is important to have a system with minimum operator interface and more of automation so that the productivity, quality, safety and OTIF deliveries are ensured.

Benefits:

The converting of Jumbo to child rolls to packed goods is a batch process involving intervention of operators. Over a period of journey, the system is made more automatic using latest available technology to minimise the setup time, change over time and down time.

Automation ensures good quality of conversion and packing due to its inbuilt sequence of reliable operations.

Systems are developed to ensure minimum operator intervention to minimise mistakes in data entry, wrong operations and unsafe acts. Many mistake proofing concepts are inbuilt in the automation system with proper interlocks.

The automation system enables to convert and convey to the despatch section with dynamic real time information to the marketing team on the manufacturing status of a particular customer order.

Conversion from Jumbo reel to Child Rolls:

Winder Operation:

The Production planning of the board machine starts with the Customers orders.



The orders received from various customers are collated based on the Paperboard grade with the help of ERP and MES solutions. The orders thus collected are narrowed down to a specific paper machine based on the time availability and capability of the Machine.

The orders are combined with the help of best in class trim optimisation module to issue the "Machine Run" to the paper machine. Trim optimisation module provides deckle optimisation for rolls and sheeting operations.

Each and every jumbo produced in the paper machine is assigned to a specific "Machine run" as per the required quantity. A barcode label is generated from Manufacturing Execution System (MES) and attached to each and every jumbo. The system has the checks and balances to ensure only required quantity is produced against a run to avoid excess inventory.

The jumbo reel produced in the paper machine is cut into small rolls at the winder as per the Customer order.

Process Automation:

Preparatory sequence for the Jumbo reel conversion to child rolls includes automation to convert the reels with a fast ramp up and ramp down automatic operation. Customer sizes are set with the facility of digital display of slitter knife position using tempasonic magnetic sensors. Once the operator sets the cut sizes, Web is passed from Unwind onto the drums by placing core pipes. The operation happens in auto sequence.

Once the run command is given, the winder will automatically speed up to the set value a predefined acceleration maintaining automatic digital tension control and will decelerate to stop the winder in pre-set dia/length.

Winder is equipped with auto Roll eject sequence through high end automation PLC which stops the machine in pre-set dia/length, retrieve the core chucks, lift the rider, put the cradle in position and gives ready to eject signal. Upon the signal ejector ejects the rolls onto the cradle, meanwhile the core chucks will come down and be ready in pre-set reference position for the next run. The web is cut automatically to enable operator to remove the child. Preloaded set of core-pipes are automatically placed between the winder drums for next set of run.

Operator moves the cradle down to push the reels onto the reel conveying system. These automatic features enable the faster winding of good quality rolls. Once the paper in the jumbo reel is completely emptied out, the empty spool will be ejected onto the unwind stand resting arms to enable operator to place a new Jumbo reel for next run.

The system is controlled by various latest technology equipment like Digital AC drives, Advanced current generation Programmable logic controllers, Servo motors, servo drives, Digital encoders, Tempasonic sensors, Intelligent MCCs controlled through latest profibus communication systems.

Operator panel is equipped with an advanced HMI with various information on alarms, events and controls with digital display.

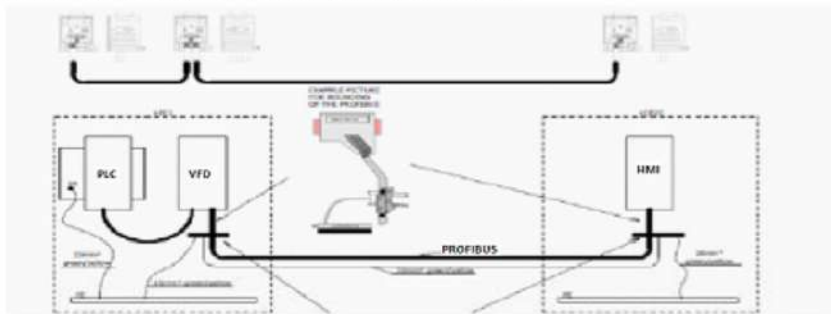
CCTVs are equipped with the Winder machine to facilitate the operator to monitor the Slitter area which is not visible from operator station location.

Alarm system enables people surrounding the equipment to be alert while the start-

up sequence, ejection sequence are in progress.

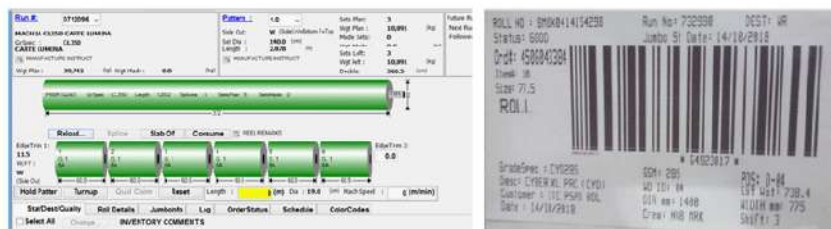
Safety Gates, and Safety sensors, positive interlocks are provided so that no person enters into the running equipment without the operator enabling permission in the operator panel.

Integration with Manufacturing Execution system:



For every ejection sequence the child roll actual dia/length is being transferred to MES system from PLC for label generation. For this the OPC servers is connected to the Winder PLC and MES.

Each and every roll produced from the winder is attached with a bar code label to identify the roll throughout its travel till the Customer's place. The Jumbo reel is assigned to a particular run and the barcode labels are generated based on the assigned run and the bar code label generated from the MES is having the roll information as given in the figure.



System Checks for further processing:

Quality of each and every roll is checked and cleared for further processing. The quality status of the roll (Good, Hold or Reject) is recorded in the MES and the reel is sent to the roll handling system conveyors.

Roll handling and Packing system:

Operation:

The child rolls are conveyed over a set of conveyors post bar code label insertion. These rolls pass through the measuring station and a scanner to choose the destination. Packing machine ensures poly wrapping with customer label. The entire process is fully automated from winder delivery conveying system till the packed reels are picked up by the clamp truck for despatch/storage.

Process automation:

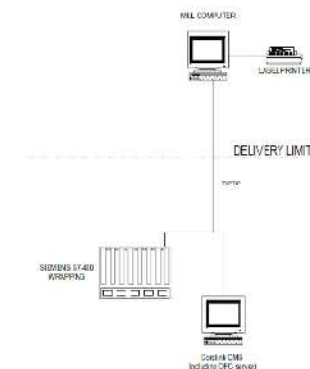
The rolls are transferred through conveyors to the Lowerator via Roll ID station. In this station the actual width of the reel is measured by a photocell & encoder combination and the diameter is measured by a laser sensor. The Barcode label attached to the reel also is scanned by the bar code scanner to read the Diameter, Width and destination of the reel. The actual measurement and the data available in the Barcode label is compared to check whether the labelling done properly.

Based on the destination the child rolls are transferred to either reel packing machine or to the storage for sheeting. According to the roll width and capacity of the Lowerator

w.r.t. length, the accumulation conveyor accumulates/does not accumulate the roll before sending the same to the Lowerator.

Lowerator bring down the roll to the Finishing House and based on the status & destination of the roll, the Lowerator turntable turns to delivers the roll either to sheeter conveyor or to the reel packing machine conveyor. If a roll order roll is found to be defective, the roll is kicked out from the Conveyor by the kicker prior to packing station.

The good rolls meant for packing is moved to the weighing scale conveyor and the roll weight is measured and sent to MES to print the Customer label.



In the wrapping system, roll is lifted up by the roller table for plastic film wrapping.

Based on the dimensions of the roll, the roll packing machine picks up the required side discs and bring to the side disc cutter. The side discs are cut to the correct diameter (to match the diameter of the roll) and transferred to side disc up-ender where the side disc is raised to vertical position. In this position the side disc holder collects the side discs, turns 180

degrees and position the discs to the roll before wrapping.

Based on the measured width of the roll, the film dispenser approaches the roll to apply the film onto the roll. The film is attached to the roll by means of hot melt and then spirally applied all over the body based on No. of wraps selected by operator.

Customer label is printed based on the

barcode label and the weight measured by the weighing scale. The label is picked up by the label carriage and brought to the packing machine label tray. At the end of the film packing the label is dropped along the film during the roll wrapping operation. The label will be visible through the transparent film. Once the Customer label is generated/wrapped in MES, the finished good inventory is updated in the Godown. Now the stock is ready for despatch.

Reel Packing Machine equipped with Safety light curtains at entrance to Lowerator and reel packing machine. The fencing gates are interlocked such that no unauthorised entry in reel packing machine area.

The WMS system enable

- Storage/Pick up of material to/from bin is proposed by system
- Seamless updation of data in SAP while storing and retrieval of stocks
- Improvement in throughput –More despatches
- Improved visibility of stocks at Paper go down
- Improved efficiency and accuracy in physical verification process
- Improvement in manpower productivity



The wrapped rolls are conveyed on continuous or stored basis to reel Up-ender. The packed rolls are raised to a vertical position. The rolls are transferred onto storage conveyor where the clamp truck picks them up.

A magnetic detection loop is installed in the floor to prevent the conveyor from moving while a truck is present in the area.

Automation involves Digital AC drives for AC motors, Siemens WINCC with complete roll moving dynamic data, Alarms, events, messages, diagnostic information and manual selection for maintenance. Digital encoders, Laser sensors, barcode scanners, position sensors are installed for fulfilling automatic operations.



Despatch through ERP

Based on the Customer priority and stocks availability at the Go down, Delivery orders are prepared in ERP and shared with the Go down. Delivery order will have the information like Customer, order/ despatch quantity and destination.

Trucks are planned based on the Delivery orders.

Based on the delivery order a pick list is generated in ERP Such picklist will have the Finished goods availability and its location/Bin. Finished goods are identified with the help of handheld terminal connected to WiFi. The Finished goods are picked from the respective locations and brought to the loading bay for loading. Such Finished goods are checked and confirmed for the particular delivery order. The FG is loaded into the respective truck and confirmed. Based on the confirmation, a packing list is generated automatically and the invoice for the specified delivery order is generated.

Systematic storage and retrieval system by using WMS system

When the Reels/Sheets are posted from MES to ERP, WMS system creates Transfer requirement document. Each and every Finished Goods is given an identity by a specially defined barcode label as given in the below fig. When Forklift operator swipes HHT (Hand held terminal) on Barcode, System proposes the Bin and Position for put away. Forklift operator will place the material in the system proposed location and confirms.

The commercial details are flowing from ERP automatically to prepare the final invoice.

